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SHORT COMMUNICATION

A TECHNIQUE FOR INDIVIDUALLY IDENTIFYING TARANTULAS USING PASSIVE INTEGRATED TRANSPONDERS

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ABSTRACT. A surgical technique for implanting passive integrated transponders into theraphosid spiders is described. An effecitve procedure for anesthesia was developed. Transponders were implanted in the opisthosomas of 12 spiders. No mortality occurred, and all spiders regained normal behavior. In simulated burrows, tarantulas could be identified to a depth of 16 cm.

Keywords: PIT tags, spider marker, Theraphosidae

No complete life history study of a theraphosid spider has appeared since the pioneering work of Baerg (1958). A necessary component of such endeavors is the application of a marker that enables the researcher to permanently distinguish individual spiders. Marking theraphosids is particularly difficult because they molt regularly (Baerg & Peck 1970) throughout their long life of 20 years or more in some females (Marshall 1996). A marker should be internal and identifiable for many years to be useful in long-term life history studies of tarantulas.

Widespread use of passive integrated transponders, which are commonly known as PIT tags, in vertebrate studies suggests that an application might be found for tarantulas. These devices are small and can be read by a hand-held reader emitting low-frequency radio waves. The transponder signal is received, decoded, and displayed by the reader as a unique 10-character code. The transponders are hermetically sealed in biocompatible glass and appear to have an unlimited life span. Although widely used by zoo personnel, vertebrate field biologists and veterinarians (Elbin & Burger 1994), this is the first time—to our knowledge—that PIT tags have been used in an invertebrate. For large arachnids this technology provides the perfect marker, being permanent, unrecognizable and untransferable to other spiders, benign in its effect on survival, and easy to apply especially under field conditions (Evans & Gleeson 1998).

The technique was tested on adults of *Aphonopelma baergi* (n = 4; body length 38–47 mm), *Brachypelma albopilosum* (n = 4; body length 38–75 mm), and *Grammostola pulchra* (n = 4; body length 62–68 mm). *Aphonopelma* were collected as adults, 10 km north of Jessieville, Garland County, Arkansas. *Brachypelma* and *Grammostola* were obtained as captive-bred juveniles from commercial suppliers in the United States and reared to adulthood. Transponder implantations were performed in the veterinary hospital at the Memphis Zoo and field trials were conducted on zoo grounds. We used the Trovan® (Grossbuilesheimer, Str. 56, Euskirchen 16, Germany) reader (Model LID 500) and transponders in all trials. The location for implantation of the transponder was on the dorsolateral aspect of the opisthosoma in an area between the heart and the intestinal tract (Fig. 1). Tarantulas were restrained by hand during the procedure. A 20-gauge hypodermic needle was used to scrape the setae from a 1.5 × 1.5 mm area of the opisthosoma, and swabbed with a 10% povidone-iodine solution. The sterile needle was used to cut the exoskeleton. The sharp apical edge of the needle was used like a scalpel rather than creating a puncture wound. The transponder was inserted into the opisthoma with sterile mosquito forceps. The surgical site was then swabbed dry and several drops of n-butyl cyanoacrylate adhesive glue (Vetabond®, 3M Animal Care Products, St. Paul, Minnesota) were used to close the wound. The entire procedure took 2–3 minutes per spider. Leakage of haemolymph varied. In one instance there was a moderate loss of fluid from the site, but the spider recovered fully.

Four of the spiders (*A. baergi*, n = 2; *B. albopilosum*, n = 2) were anesthetized prior to implantation. Spiders were immobilized with isoflurane (Iso-thesia™, Abbott Laboratories, North Chicago, Illinois). A cottonball was soaked in the anesthetic agent and placed in a small plastic container away from the spider. The effect of the anesthetic was monitored by leg movement. As the spiders became

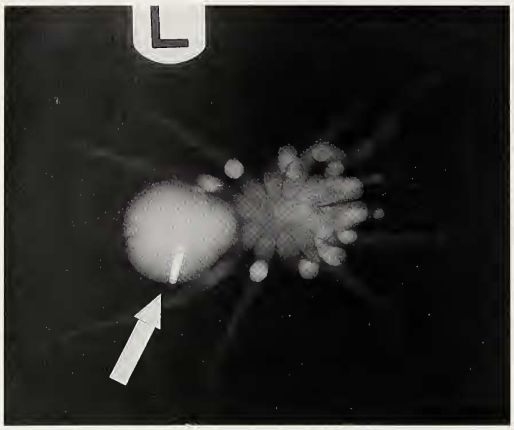

Figure 1.—Radiograph showing passive integrated transponder (arrow) implanted in a *Grammostola pulchra*.

anesthetized the legs contracted followed by relaxation.

Spiders which were not anesthetized during transponder implants accepted food within several hours, suggesting they had not been severely traumatized by the procedure. Anesthetized spiders required 2–3 hours post-surgical recovery time before normal movement was exhibited. All spiders which had implants completed ecdysis within 3–7 months. After molting, no evidence of the implants was noted. All spiders were preserved after two years. Voucher specimens were deposited in the Field Museum of Natural History, Chicago.

To assess the limits of the reader in decoding the transponder signal from implanted spiders *in situ*, we conducted trials using artificial burrows. A natural burrow replica was prepared by boring a 5 cm diameter hole at an 80° angle to a depth of 20 cm. Trials were conducted in hard-packed humus on a rainy day to simulate typical field conditions for many species of theraphosids. Spiders were identifiable in the burrows at a depth of up to 16 cm. This distance approaches the 18–20 cm detection limit of the reader across unobstructed space.

This technique is best suited for long term field studies of large, long-lived arthropods such as theraphosid spiders, scolopendrid centipedes, and scorpions. The sensitivity-level of the reader precludes identification of theraphosids resting at the bottom of deep burrows. However, tarantulas could easily be identified at night while they are passively foraging at their burrow entrance, eliminating the time-consuming process of capture and handling. Anesthesia prior to implantation is unnecessary and not convenient under field conditions, but it is tolerated by the spiders. Untrained personnel may consider anesthetizing specimens until they become more adept at inserting the transponders.

Short-term movements such as the migration of male tarantulas during the breeding season can be monitored by radio telemetry (Janowski-Bell & Horner 1999). However, limitations in battery life, durability of transmitter adhesion, and the potential for these transmitters to interfere with normal behavior make radio telemetry unsuitable for studies conducted over a longer time scale. We believe this new application for PIT tags offers a way to study previously inaccessible aspects of theraphosid spider biology such as growth, survivorship, and the movements of individuals over their entire lives.

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